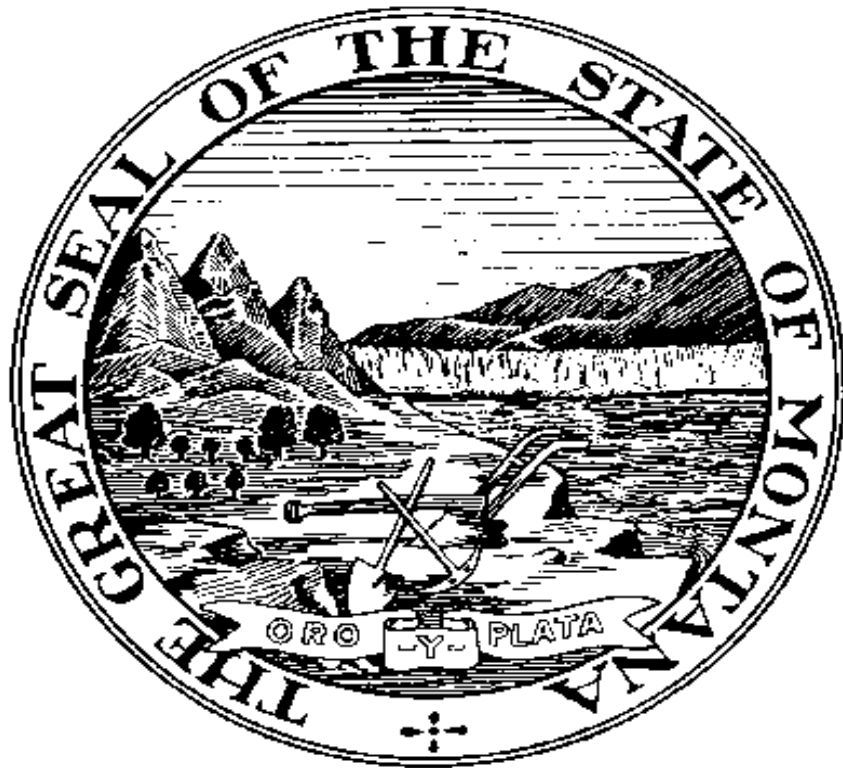


Dermatitis Prevention

Occupational Skin Disorders

Occupational Safety and Health Bureau



Montana Department of Labor and Industry

Prepared for Montana Employers
by the

Occupational Safety & Health Bureau
Department of Labor and Industry
P.O. Box 1728
Helena, Montana 59624-1728
(406) 444-6401

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Occupational Skin Disorders

Occupational skin disorders are a significant cause of impairment and disability that in many cases are entirely preventable. There is virtually no occupation or industry without potential exposure to the many diverse agents that cause dermatitis. Because of the large surface area of the skin, it is very vulnerable to occupational hazards.

The U.S. Bureau of Labor Statistics (BLS) estimates that the annual losses resulting from occupational skin disorders to range between \$222 million and \$1 billion. These huge losses result from lost worker productivity, lost work time, medical care, and disability payments.

Dermatitis is the second most common reported occupational disease in the U.S. despite being commonly underreported. Irritant contact dermatitis is the most common occupational skin disease and usually results from toxic reactions to chemical irritants such as cutting oils and solvents.

This handout will present information and protection guidelines to aid employers in preventing occupational dermatitis in their workplaces. Employers can use this handout as part of their hazard communication program (see 29 CFR 1910.1200 for the Hazard Communication standard). Topics discussed in this handout include: definitions, causes of occupational skin disorders, predisposing factors, control measures, and personal protective equipment (PPE).

I. Definitions

Corrosive. A substance that causes visible destruction or permanent damage to human tissue at the site of contact.

Dermatitis. Inflammation of the skin.

Dermis. Deep layer of skin, containing connective tissue, blood vessels, nerve fibers, receptor organs, muscular elements, hair follicles, and oil and sweat glands.

Epidermis. The top layer of skin composed of dead cells.

Irritant. A substance that produces an irritating effect when it contacts skin, eyes, nose, or respiratory system.

Sensitizer. A material that can cause an allergic reaction of the skin or respiratory system.

II. Causes of Occupational Skin Disease

There are many substances and conditions capable of inducing a skin disorder in the workplace. Most of the cases of occupational dermatitis come from the following hazards:

- ◆ Chemical
- ◆ Mechanical
- ◆ Physical
- ◆ Biological
- ◆ Botanical

A. Chemical Hazards

The list of hazardous chemicals that can damage the skin is immense and always increasing because new chemicals are constantly produced and used. Chemical agents can be divided into two main groups: primary irritants and sensitizers.

1. Primary Irritants

Most occupational dermatitis is caused from contact with primary irritant chemicals. Primary irritants alter the chemistry of the skin and destroy its protection abilities. After the skin's surface has been damaged, irritant contact dermatitis can occur. This reaction can cause tissue destruction (chemical burn) or inflammation (dermatitis) depending on the strength of the chemical and the duration of exposure.

Many irritants are water-soluble and can react with certain components of the skin. Water-soluble chemicals, including many solvents, react with the lipid (fatty) elements of the skin. Please see Appendix A. for a list of some chemicals that can cause dermatitis.

Primary irritants act directly on the skin in one of the following ways:

- Chemically reacting with it,
- Dissolving or abstracting from it some of its essential components,
- Denaturing the proteins of the skin, or
- Disturbing the skin's membrane and its ability to retain moisture.

Primary irritants include:

- a) *Keratin Solvents* include soaps, alkalis, and most organic solvents. These agents soften the keratin cells of the skin and bring about water loss resulting in dry, cracked skin. This damage to the skin can increase the susceptibility to secondary infections.
- b) *Fat and Oil Solvents*, which include detergents and most organic solvents, are capable of removing the surface lipids and reducing the skin's ability to hold water.
- c) *Protein Precipitants* are chemicals that denature protein cells in the skin. These chemicals include alcohol, formaldehyde, phenol, and heavy metal salts.
- d) *Dehydrators* include inorganic acids, anhydrides, and alkalis such as calcium oxide. These substances take the water out of the skin and generate heat.
- e) *Oxidizers* are chemicals that react with hydrogen and remove oxygen from the skin. Nitrates, chlorine, bromine, ammonia, and hydrogen peroxide are oxidizers of the skin.
- f) *Reducers* are chemicals that react with water on the skin to remove hydrogen and weaken the outer layer of skin. Tar, aromatic and aliphatic hydrocarbons, formic and oxalic acids are reducers.
- g) *Keratin Stimulants* are chemicals that stimulate abnormal growth in the skin causing tumors or cancer formations. Certain petroleum products, coal tar based materials, arsenic, and some chlorinated hydrocarbons are keratin stimulants.

Two Major Classes of Primary Irritants

- a) Absolute Primary Irritants are corrosive substances that injure the skin immediately following first contact. Examples include strong acids and bases, metallic elements and their salts.
- b) Relative Primary Irritants are less toxic substances that require either repeated or prolonged contact to produce inflammation. Examples include soaps, detergents, and most organic solvents.

2. Allergic Contact Sensitizers

Sensitizers do not cause visible skin changes following first contact, but produce a specific acquired alteration in the capacity of the skin to react, brought about by an antibody- like mechanism.

Chemicals that cause skin sensitization are far fewer than those that cause primary irritation. Examples include poison ivy, epoxy, formaldehyde, ammonia, germicidal agents, nickel compounds, mercury compounds, cobalt compounds, and coal tars. Some compounds, such as turpentine and chromic acid, cause both primary irritation and sensitization.

Workers can also become sensitized by latex in rubber gloves; latex allergies can develop and in some cases create serious health problems. Please see the latex allergy handout for more information.

The Development of Allergic Contact Dermatitis proceeds in the following steps:

- 1. The refractory period is the time during which contact with a potential allergen occurs without the development of sensitivity.
- 2. The latent or incubation period is the time during which development of sensitization occurs. Once this process stops, five to several weeks are required for full sensitization to occur.
- 3. The reaction period occurs when fully sensitized skin is reexposed to the allergen, resulting in an inflammatory response at the site of contact. This reaction usually begins within 12 hours, peaks at 24 to 48 hours, and then slowly subsides.
- 4. The period of persistence of sensitivity is the time during which no further contact with the allergen occurs, and the level of sensitivity gradually declines. The rate of decline is variable: some sensitivities remain for many years, other disappear rapidly.

Photosensitizers

Certain chemicals are capable of reacting with specific wave lengths of natural and artificial light to cause phototoxic or photoallergic dermatitis. The best known industrial chemicals with this capacity are derivatives of coal tar (anthracene, phenanthrene, and creosote) and certain dyes.

B. Mechanical

Trauma at work can be mild, moderate, or severe and occur as a single or repeated event. Friction results in the formation of a blister or callus. Other skin injuries can occur from contact

with sharp objects or from being struck by a hard object. An example of a material that can cause dermatitis is fibrous glass, which can cause irritation, itching, and scratching. Secondary infection may complicate blisters, calluses, or breaks in the skin.

C. Physical

Physical agents such as heat, cold, and radiation can cause occupational dermatitis. Heat can soften the outer layers of skin, leading to heat rash. Burns can result from electric shock, contact with hot objects, molten metal and glass, and solvents or detergents used to elevate temperatures.

Exposures to cold temperatures can cause frostbite and result in permanent blood vessel damage. Cryogenic gases and liquids can also cause frostbite and deep skin cell damage. Some cryogenic liquids include nitrogen, argon, and helium.

Sunlight is the greatest source of skin-damaging radiation and can lead to skin cancer if the skin is repeatedly burnt. Casual or prolonged contact with artificial ultra violet (UV) light sources such as molten metals and glass, welding, and plasma torches can also burn the skin.

D. Biological

Bacteria, viruses, fungi, and parasites can also cause infections and occupational skin disorders. Animal breeders, agricultural workers, tannery workers, bakers, culinary employees, florists, and laboratory technicians are among those at greater risk of developing infections. Examples include anthrax in hide processors, yeast infections of the nails of dishwashers, bartenders, and others engaged in wet work, and animal ringworm in agricultural workers and veterinarians. Parasitic mites are common inhabitants of grain and other foodstuffs and attack workers handling such materials.

E. Botanical

Many plants and woods, such as poison ivy and poison oak, can cause contact dermatitis. Many weeds and flowers can cause both irritant contact dermatitis and allergies.

III. Predisposing Factors

There are many predisposing factors that make a person more likely to develop occupational skin dermatitis that should be considered before assigning workers to tasks that have the potential for the development of dermatitis. Predisposing factors should also be used for developing protective measures. Predisposing factors for the development of occupational dermatitis include age and experience, skin type, sweating, gender, seasons and humidity, personal hygiene, and preexisting skin disease.

Age and Experience

Younger, inexperienced and inadequately trained workers have a higher prevalence of occupational skin disorders than older ones. Older workers may be prone to chronic skin irritation because their skin is usually drier.

Skin Types

Heavily pigmented skin appears to resist the harmful effects of external irritants more effectively than light skin. Workers with naturally dry skin are less able to tolerate the action of solvents and detergents. Those with oily skin are predisposed to developing acne-like lesions.

Sweating

Increased sweating can irritate the skin and increase the risk for developing dermatitis. Sweating softens the skin and opens it up for the development of secondary fungal and bacterial infection. Sweating can also be beneficial in diluting concentrations of toxic substances on the skin.

Gender

Women usually report fewer occurrences of dermatitis than men; this could be because of better hygiene practices and less exposures to toxic substances. However, women are usually more easily sensitized.

Seasons and Humidity

Occupational dermatitis is generally more common during warm weather. During warmer weather workers tend to wear less clothing and are more likely to have skin exposed to external irritants. Also when workers are hot they are less likely to wear personal protective equipment (PPE). Climates with low humidity dry out the skin making it easier for toxic agents to attack it.

Personal Hygiene

Poor personal hygiene is a major factor in the cause of occupational dermatitis. Unwashed skin and unchanged clothes can cause prolonged contact to chemicals. Adequate facilities for maintaining personal cleanliness should be provided at the workplace. Employees need to be aware of the role personal hygiene plays in preventing dermatitis.

Preexisting Skin Disease

Preexisting skin diseases can be easily aggravated at the workplace by exposure to chemicals.

III. Prevention and Control

Preventing occupational skin disorders can increase work productivity, as well as decrease worker's compensation cost and lost time. Through the combined effort of management and workers, occupational skin disorders can be largely prevented. The control measures that can be used are classified as environmental, medical, and personal.

The first step that should be taken is to determine where and how workers are being exposed to hazardous agents. By doing an effective Job Safety Analysis (JSA) employers can determine what changes should be made to protect the worker and what possible hazardous agents they are exposed to. Any chemical that is used needs to be carefully identified, by generic name, determine all ingredients, and provide appropriate protection from the harmful ingredients.

A. Environmental

The primary function in preventing occupational dermatitis is to reduce the possibility of contact with offending agents. Engineering controls are the most effective means of prevention.

Engineering controls include:

- Automation: automate processes that could expose workers.
- Closed Processes: enclose processes entirely.
- Substitution: substitute harmful chemicals for low toxicity and low irritant potential chemicals.
- Ventilation: ventilate to remove hazardous agents from workplace air.
- Housekeeping: frequently clean floors, walls, windows, and machinery.
- Proper labeling and packaging: clean and label containers for shipment to prevent contact from other workers such as truckers and warehouse workers. All containers storing hazardous material must be labeled so that workers know what is in them.
- Barriers: use curtains or shields to restrict the spread of chemicals that are sprayed.

B. Medical

New applicants should be examined and those having predisposing skin conditions should not be placed in occupations where there is a skin hazard. Workers should be encouraged to report all irritations of the skin. Periodic medical exams and plant inspections should be conducted to determine the presence of skin disease.

C. Personal

Personal hygiene

The importance of personal cleanliness in the prevention of dermatitis cannot be overemphasized. In order to minimize contact with harmful agents, workers must have access to facilities for washing hands and be furnished with other means of keeping clean. It is the employer's responsibility to provide adequate washing facilities, good cleansing materials, and education on hygiene practices.

Washbasins should be well designed, conveniently located, and kept clean; otherwise they will be rarely used. The farther workers must walk to clean up, the less likely they are to do so. Inconveniently located washbasins invite such undesirable practices as washing with more easily available solvents, mineral oils, or industrial detergents, all of which can be harmful to the skin.

Employees should wash their hands before eating, drinking, smoking, using chewing tobacco, and using the restroom. Workers must also wash their hands before leaving the worksite. Frequent hand washing will also reduce the risk of chemicals being accidentally ingested.

The type of soap used is also important. Even good soaps can irritate certain type of skin. Try to choose a soap that has the following characteristics:

- Removes industrial soil quickly and effectively
- Should not dehydrate or irritate the skin under normal applications
- Should flow easily through dispensers
- Should provide protection against microbial contamination

- Should have aesthetic appeal (color and odor)

Where washing facilities are not available, waterless cleansers can be used. However, overuse of waterless cleansers can irritate and dry the skin. Workers should use a moisturizing hand lotion after applying waterless cleansers.

Barrier Creams

Barrier creams can often be used where protective clothing is inadequate or not feasible. However, barrier creams are considered the least effective way of protecting the skin. There are a variety of different types of barrier creams; some protect against wet materials and some against dry materials. When selecting a barrier cream it is important to consider the materials that the worker will be exposed to.

Personal Protective Equipment

Protective clothing acts as a barrier between the skin and irritating chemicals. Some examples of personal protective used to control dermatitis are aprons, faceshield, gloves, hair covers, and chemical-resistant coveralls.

Because workers' families can develop contact dermatitis from contact with clothing worn home from work, clothing worn on the job should not be worn at home. Clothing contaminated with chemicals should always be thoroughly laundered before they are worn again. Wearing dirty contaminated clothing can be worse than the actual exposure itself.

Manufacturers provide a large selection of protective garments made of rubber, plastic film, leather, cotton, or synthetic fiber that are designed for specific purposes. When selecting PPE it must be made from material that will provide the maximum protection and will not break down under chemical contact. Refer to manufacturer's guidelines when selecting material.

OSHA requirements for protective clothing are found in 29 CFR 1910.132, employers must follow these requirements when selecting and using personal protective equipment (PPE). The OSHA standard requires that a hazard assessment is completed and documented before employees are required to use PPE. A hazard assessment identifies all workplace hazards and the types of PPE that are needed. The standard also requires that employees be effectively trained on use of any required PPE.

It is important that all PPE be worn only when safely possible. Protective clothing, especially gloves, can be caught in machinery, resulting in injury.

Appendix A. Selected Chemical Causes of Skin Disorders

This is a limited list of chemicals; there are many more that have effects on skin.

Chemical	Primary Irritant	Sensitizer	Effect on Skin
ACIDS			
Acetic	X	?	Dermatitis and ulceration
Carbolic	X		Corrosive (tissue damage)
Chromic	X	X	Ulcers on skin
Cresylic	X		Corrosive
Formic	X		Severe irritation w/ blister and ulcerations
Hydrochloric	X		Irritation and ulceration
Hydrofluoric	X		Severe chemical burn w/blisters and erosion
Nitric	X		Severe skin burns and ulcers
Oxalic	X		Severe corrosive, cyanosis, & brittleness of nails
Picric	X	X	Dermatitis, scaling, yellow discoloration of skin
Sulfuric	X		Corrosive, severe inflammation of mucous membranes
Alkalis			
Ammonia	X		Irritation including airborne dermatitis of face
Calcium cyanamide	X		Irritation and ulceration
Calcium oxide	X		Dermatitis, burns, and ulceration
Potassium hydroxide	X		Severe corrosive, deep-seated persistent ulcers, loss of fingernails
Sodium hydroxide	X		Severe corrosive, deep-seated persistent ulcers, loss of fingernails
Sodium or potassium cyanide	X		Blisters and ulcers
Trisodium phoshate	X		Blisters, ulcers
Solvents			
Acetone	X	X	Pit like ulcers in skin, perforation of nasal septum, dermatitis
Benzene	X	X	Dry (defatted) skin
Trichloroethylene	X	?	Dermatitis
Turpentine	X	X	Dermatitis
Alcohols	X	X	Dermatitis
Petroleum and Coal-Tar derivatives			
Petroleum oils	X		Dermatitis, folliculitis
Pitch and asphalt	X		Dermatitis, folliculitis, skin cancer
Tar (coal)	X	X	Dermatitis, folliculitis, skin cancer

Insecticides			
Arsenic	X		Spotty pigmentation of skin, skin cancer, dermatitis
Pentachlorophenols	X	?	Dermatitis, chloracne
Creosote	X	X	Dermatitis, folliculitis, skin cancer
Fluorides	X		Severe burns
Phenylmercury	X	X	Dermatitis
Pyrethrum		X	Dermatitis
Rotenone	X		Dermatitis
Resins			
Rosin		X	Dermatitis
Shellac		X	Dermatitis
Synthetic resins	X	X	Dermatitis
Metal Working Fluids			
Cutting oils	X		Oil acne, and dermatitis
Coolants	X	X	Dermatitis
Oxidizing Agents			
Hydrogen peroxide	X	?	Dermatitis
Benzoyl peroxide	X	X	Dermatitis
Other			
Isocyanates	X	X	Dermatitis
Vinyl chloride	X		Dermatitis
Formaldehyde	X	X	Dermatitis
Plants, weeds (poison ivy, oak, sumac)	X	X	Dermatitis

It is important to remember that this list is just partial, there are many other chemicals and materials that can cause occupational skin disease. Any chemical that is used needs to be carefully identified, by generic name, determine all ingredients, and provide appropriate protection from the harmful ingredients.